Chapter 40. Team-Training in Health Care: Brief Update Review

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Introduction

Deficiencies in communication and teamwork have long been cited as a frequent contributor to adverse events. Precise estimates of the extent of the problem are difficult to make, given definitional issues as well as reporting and measurement problems. However, a variety of studies support the notion that teamwork and communication are critical components of safe health care systems. Previous reviews have reported linkages between various aspects of teamwork (e.g., situational monitoring, communication, leadership, trust, shared mental models) and clinical performance.[1-3] For example, observational studies in the surgical domain have shown increased odds of complications and death (odds ratio 4.82; 95% confidence interval, 1.30 –17.87) when surgical teams exhibit less frequent teamwork behaviors (e.g., less information sharing during intraoperative and handoff phases, and less briefing during handoffs).[4] Reviews of malpractice claims indicate that communication problems are major contributing factors in 24% of cases that result in such claims.[5] Other studies using root cause analysis to examine contributing factors have found teamwork and communication issues cited as root causes in 52% to 70% of adverse events.[6,7] Additionally, teamwork and communication dimensions of safety culture have been significantly related to adverse clinical events.[8,9]

The 2001 Making Health Care Safer report reviewed the topic of team-training in a review entitled, Crew Resource Management and Its Application in Medicine. This review discussed early conceptualizations of team-training in other high reliability industries such as aviation and summarized early studies attempting to translate team-training principles developed elsewhere into health care settings. The development and implementation of team-training programs has grown dramatically in the last decade with improvements in the content and methods of training.[10] Additionally, there is over 30 years of evidence examining team performance processes and the impact of team-training across a wide variety of highly complex, high-risk work environments.[11] This review provides an update on the implementation and effectiveness of team-training in health care.

While there has been no previous comprehensive formal systematic review dedicated uniquely to team-training in health care to date, a systematic review of interventions to improve team effectiveness in health care found that the majority involved some form of team-training (42 of 48 reviewed studies).[10] Several systematic reviews with narrowly defined foci have investigated the effectiveness of team-training for obstetric emergencies,[12] for enhancing communication in surgery,[13] and classroom-based team-training interventions[13,14] for example. Additionally, several narrative reviews have investigated the content, design, and delivery of team-training and the impact of team processes in health care.[2,15,16] We draw on results from these previous reviews to describe articles on interventions involving team-training.

What Is Team-Training?

Team-training is defined as a constellation of content (i.e., the specific knowledge, skills, and attitudes that underlie targeted teamwork competencies), tools (i.e., team task analysis,

performance measures), and delivery methods (i.e., information, demonstration, and practice based learning methods) that together form an instructional strategy.[17] In this sense, team-training is a systematic methodology for optimizing the communication, coordination, and collaboration of health care teams that combines specific content with opportunities for practice, formative feedback, and tools to support transfer of training to the daily care environment.

As described in the National Quality Forum's "34 Safe Practices for Better Healthcare" in the 2010 Update, teamwork training and skill building is defined as follows:[18]

> "Healthcare organizations must establish a proactive, systematic, organization-wide approach to developing team-based care through teamwork training, skill building, and team-led performance improvement interventions that reduce preventable harm to patients…training programs should systematically address and apply the principles of effective team leadership, team formation [and team processes]"

Borrowing from other high reliability communities, the concept of team-training in health care originated in the form of Crew Resource Management (CRM), a specific team-training strategy focused on developing a sub-set of teamwork competencies generally related to hazard identification, assertive communication, and collective management of available resources (e.g., people, tools, and information).[19-21] However, the practice of team-training has become much more broadly conceptualized in health care as the science dedicated to understanding team processes, and performance has grown. Today, team-training is an overarching term that encompasses a broad range of learning and development strategies, methods, and teamwork competencies. The critical element is that the learning activity focuses on developing, refining, and reinforcing knowledge, skills, or attitudes that underlie effective teamwork. This differentiates team-training activities from technical or procedural learning activities that are focused on developing technical clinical skills (e.g., cognitive skills such as differential diagnosis and procedural skills).[22] Prior narrative reviews of team-training interventions in health care have found that the most commonly targeted teamwork competencies include communication, situational awareness, leadership, role clarity, and coordination.[13-16,23,24]

What Is the Context for the Use of Team-Training?

Previous reviews highlight that team-training has been implemented across a broad range of contexts using a variety of implementation strategies and learning modalities.[2,3,16,23,25] This includes academic hospitals (e.g.,[26]) and community based hospitals (e.g.,[27]),[28] as well as medical centers affiliated with the VA and the Military Health System.[29] Additionally, team-training programs have focused on a variety of audiences including both current practitioners (e.g.,[30-32]) and trainees (e.g.,[33]).

In terms of implementation strategy, both train-the-trainer and direct train-the-staff strategies have been utilized. For example, a train-the-trainer model formed the foundation for the National Implementation of TeamSTEPPS Project,[34] a collaborative effort of Department of Defense (DoD), the Agency for Healthcare Research and Quality (AHRQ), and the American Institute for Research (AIR) designed to create a national training and support infrastructure for health care entities implementing team-training. Through a national network of five team resource centers, individuals interested in leading the implementation of team-training within their organization could become TeamSTEPPS Master Trainers by participating in an intensive 3-day training

session. Master Trainers then train administrators and frontline personnel within their own organization using the customizable TeamSTEPPS curriculum. A slightly different approach was utilized in the large-scale implementation of team-training throughout the Veterans Administration (VA). As part of the VA National Center for Patient Safety Medical Team Training (MTT) program learning sessions for participating VA medical centers were facilitated directly by an interdisciplinary team (physician, nurse) of dedicated MTT faculty.[35,36] Both strategies, however, include local facility change teams, implementation of on-the-job tools (e.g., process checklists, scripts) to support training transfer, and measurement and evaluation processes as integral implementation components.

What Have We Learned About Team-Training Effectiveness?

Team-training provides an opportunity for health care providers to learn, refine, and practice different strategies for communication, leadership, coordination, and collaboration. A meta-analysis of team-training that included 93 effect sizes across a broad range of industries found that participation in team-training can account for nearly 20% of the variance in team processes ($\rho = 0.44$) and outcomes ($\rho = 0.39$).[17] Additionally, similar effect sizes were found for teams who worked together on a regular basis (intact teams $\rho = 0.48$) and teams who did not (ad-hoc teams $\rho = 0.44$). Previous reviews examining the relationship between teamwork and patient safety reported significant relationships between both provider ratings and observer ratings of teamwork, risk-adjusted mortality and length of stay.[3]

While no previous comprehensive systematic review has been dedicated uniquely to team-training in health care to date, a descriptive systematic review through April 2008 of interventions to improve team effectiveness in health care found that the majority involved some form of team-training (42 of 48 reviewed studies); other interventions focused on tools to support team effectiveness (e.g., checklists, goal lists; 8 studies) and organizational interventions (e.g., redesign of care processes or team structures, 8 studies).[10] This review included 32 studies dedicated specifically to some form of team-training, including 7 studies of simulation-based team-training, 8 studies of training based in CRM, 6 studies of interprofessional training, and 11 studies dedicated to other forms of team-training.[10] The review found no studies that evaluated exactly the same intervention. This lack of study homogeneity is an important consideration in evaluating the evidence for such patient safety practices, given that local customization is a common practice, and underscores the need for high quality implementation studies designed to study variation in training design and implementation. Another descriptive systematic review limited to classroom-based team-training interventions published through March 2010 included 18 studies.[14] This review excluded web-based, simulation-based, mono-disciplinary studies as well as studies conducted outside of the hospital setting. Based in Kirkpatrick's four-level model of evaluation,[37] this review found 6 studies evaluated participant reactions to training, 9 studies evaluated training effects on behavior change, 7 studies evaluated processes measures, and 4 studies evaluated the impact of team-training on patient outcomes.

Overall, prior reviews concluded that team-training interventions are effective in improving teamwork and patient safety related attitudes, producing learning, and changing teamwork and communication behaviors in a variety of clinical areas.[12,14,28,38,39]

More recently, some studies have shown a significant impact of teamwork training programs on safety and quality metrics. An evaluation of the Veteran's Affairs Medical Team-Training program showed significant and sustained decreases in preoperative delays (from 16% to 7% of cases, $p = .004$), increased antibiotic prophylaxis compliance (from 85% to 97%, $p < .0001$),

decreases in equipment issues/case delays (from 24% to 7% of cases, $p < .0001$), decreased handoff issues (from 5.4% to 0.3% of cases, $p < .0001$), and most notably a reduction in mortality ($p = .01$).[36,40,41] Additionally, a dose-response relationship was established such that for each quarter the program was in place at a facility, a decrease of 0.5 deaths per 1000 procedures ($p = .001$) was observed. Implementation of a related team-training program jointly developed by the Agency for Healthcare Research and Quality and the Department of Defense, TeamSTEPPS®, has been associated with increased efficiency in clinical processes for multi-disciplinary trauma teams (e.g., decreased times from arrival to surgery from 130.1 to 94.5 minutes ($p < .05$), endotracheal intubation from 10.1 to 6.6 minutes (n.s.), and CT scan from 26.4 to 22.1 minutes ($p < .01$)[42]) as well as an 83% reduction in medication and transfusion errors ($p < .001$) and a 70% reduction in needlestick injuries and exposures ($p < .05$) in a U.S. Combat Support Hospital deployed in Iraq.[29] Other studies have also reported significant reductions in clinical decision time ($p < .05$)[43] associated with team-training, as well as one study showing a reduction in adverse clinical events and a 50% reduction in high severity malpractice claims (pre-training 11 high severity claims, post-training 5 high severity claims, no statistics reported).[44]

Overall, the systematic review by Buljac-Smardizic[10] concluded that the majority of studies reviewed were of low to moderate level quality; however, eight of the reviewed team-training studies were categorized as high or moderate quality (i.e., RCT or high quality pre-post study). In the review by Rabøl[38] of classroom-based team-training interventions 15 of the 18 reviewed studies were uncontrolled and 17 studies were rated at a moderate or high risk for bias.

What Have We Learned About Team-Training Design and Delivery?

Several narrative reviews of team-training and team processes in health care have also examined how team-training curricula are being designed and delivered as described in the published literature.[1,13,15,23,24,38,45,46] These reviews find variation among team-training programs in terms of how much time learners spend in training, how often clinicians and staff are participating, and other details regarding content, delivery strategies, and evaluation efforts.

For example, programs vary in the instructional methods utilized. Instructional methods can be conceptualized in terms of three broad categories: (1) information-based methods (e.g., didactic lecture), (2) demonstration-based methods (e.g., behavioral modeling, videos), and (3) practice-based methods (e.g., simulation, role-playing). Previous reviews have found that the majority (83%) of team-training programs integrated both information and practice-based methods and that 68% reported using simulation-based learning in order to provide trainees with the opportunity to practice and refine teamwork skills, as well as receive formative feedback.[23] Only 35% of studies in this prior review, however, reported incorporating demonstration-based learning opportunities.

Variation in program duration is an additional example. A review of 18 studies evaluating classroom-based team-training interventions found course duration varied from 4 hour to 3 days with several studies describing longer train-the-trainer programs.[38] Another review found that 53% of 40 reviewed team-training programs were designed to last less than 1 day.[14]

In terms of structure, team-training in health care has been conducted with both in-tact (i.e., teams who have worked together currently) and ad-hoc teams (i.e., teams formed for training purposes only). For example, Weaver[14] found 8 studies reported training in-tact teams and 5 studies reported training in ad-hoc teams.

Overall, no comprehensive meta-analysis to date has directly examined training duration, format, or other variations in design or delivery as boundary conditions influencing the effectiveness of health care team-training programs. Multi-site studies such those of the VA Medical Team Training program and TeamSTEPPS® and comparative effectiveness studies are important for establishing robust evidence regarding questions of how much, how often, and through which modalities team-training is most effective for inpatient, outpatient, and long-term care health care settings.

Conclusions and Comment

In summary, previous reviews of team-training in health care and more recent publications have found that can improve teamwork processes (e.g., communication, coordination, and cooperation), and that implementation of team-training programs has been associated with improvements in patient safety outcomes (e.g., reductions in adverse events, reductions in mortality). Several narrative reviews have examined how team-training is being developed and delivered in health care.[15,17,23,24] In terms of the strength of evidence, the previous systematic review[10] included several studies that utilized RCT or controlled pre-post designs and several large-scale studies examining the impact of comprehensive team-training strategies have been published since this review. However, it is important to also note that previous reviews reflect a wide range in the quality of evidence—with several studies of team-training being limited due to small sample sizes, weak study design, and limited detail regarding the team-training curriculum or implementation strategy.[10,23]

Our non-systematic brief review included several studies that have been published since the systematic review conducted by Buljac-Samardzic, as well as findings from previous narrative reviews. Overall, there is some moderate to high quality evidence that team-training can positively impact health care team processes and patient outcomes, as well as toolkits available to support the development and implementation of team-training programs. For example, the comprehensive TeamSTEPPS© curriculum is available publically through AHRQ (www.teamstepps.ahrq.gov) and there are five Team Resource Centers available nationally that provide TeamSTEPPS Master Training. Additionally, the VA Medical Team Training program is available to VA Medical Centers through the National Center for Patient Safety (www.patientsafety.gov/mtt). There is also a large body of work dedicated to examining the effectiveness of team-training interventions across a wide range of industries available to inform training design and delivery decisions.[47]

To continue building this evidence base, future work should continue to evaluate team-training. This includes evaluating the impact of team-training on patient safety outcomes, evaluating team-training in other settings (e.g., primary care, outpatient dialysis care settings), examining the comparative effectiveness of different methods for delivering team-training, and examining implementation methods to support sustainment of behavior changes achieved through training. For example, there is little evidence available to date that provides insight into the frequency of retraining or dedicated practice needed to develop and maintain effective teamwork skills. Additionally, there is a need to examine how dynamic team composition (i.e., changes in team membership) moderate team processes and the effects of team-training. Methodologically, robust validation studies are needed to strengthen the evidence surrounding the indices used to measure teamwork processes within health care and more studies that utilize robust experimental designs are needed. Finally, longitudinal studies and studies that address the integration of team-training concepts throughout the career development of health care

professionals, from basic through continuing education, are needed to continue building this base of evidence. A summary table is located in Table 1, Chapter 40.

Table 1, Chapter 40. Summary table

Scope of the Problem Targeted by the PSP (Frequency/Severity)	Strength of Evidence for Effectiveness of the PSPs	Evidence or Potential for Harmful Unintended Consequences	Estimate of Cost	Implementation Issues: How Much do We Know?/How Hard Is it?
Common/High	Moderate	Low	Moderate	Moderate/Moderate-to-difficult

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